UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL

Distr. : LIMITED

E/ECA/ATRCW/RCIWD.4/5
19 August 1989

Original : ENGLISH

ECONOMIC COMMISSION FOR AFRICA

Fourth Regional Conference on the Integration of Women in Development on the Implementation of the Arusha Strategies for the Advancement of Women in Africa

6-10 November 1989
Abuja, the Federal Republic of Nigeria

REPORT ON

STRATEGIES FOR IMPROVING WOMEN'S ACCESS TO EDUCATION AND TRAINING IN SCIENCE AND TECHNOLOGY IN AFRICA

INTRODUCTION

1. The low level of women's enrolment in science-based training programmes and their involvement in science based professions has been established in Kenya[1], Sierra Leone[2] and Swaziland[3].

2. Similarly, a review of women's access to education and training in science and technology shows a general and definite paucity. Several international conferences on women's education in Africa have expressed the concern about the under-representation of girls and women in science and technology. Research findings by UNESCO and other organizations have pointed out the low enrolment of girls/women in science-based training programmes and the low percentage of women's participation in scientific professions. This situation is not unique to Africa, similar trends occur in America, Europe and the other continents[4].

3. The reasons for this phenomenon of the absence of girls/women from scientific/technical studies are multiple. Among these are: historical, traditional and conventional attitudes which relegate women to the so-called "female subjects"; traditional behavior adopted both within the school and the professional world; at the national level, educational policies do not address themselves directly to the question of women's education; and poor linkages between training and employment.

4. Outside the academic streams, the problem is also acute for girls in technical subjects. Frequently the vocational schools that offer training related to the demands of the job market in technical fields admit very few girls; at other times, those admitted are channeled into domestic, poorly renumerated or dead and fields. Albeit these problems have not been properly and sufficiently documented in African countries, most of these problems affect girls directly.

5. Women's education is of fundamental importance to enhance their role and active participation in national development. Unfortunately the illiteracy rate in Africa is quite high. It is higher for women than men in many African countries. In Nigeria in 1985, 59 % of the males and 67 % females were illiterates and in Togo 59% and 74 % respectively[5]. There is also a disparity in the illiteracy rates between the urban and rural population. In Sudan 80 % of the urban children go to school

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[1] Research on "Women and the Scientific Professions in Africa: A Case Study, Kenya", 1988; UNECA/AIECW, Addis Ababa, Ethiopia.

[2] Report on "Women and the Scientific Professions in Africa: A Case Study, Sierra Leone", 1988, UNECA/ATRCW, Addis Ababa, Ethiopia.

[3] A Report on "Research on Women and the Scientific Professions in Africa: The Case of Swaziland", 1988; UNECA/ATRCW, Addis Ababa, Ethiopia.

[4] Women and Science; 1989, UN.DPI/835 (DESI-E/70).

[5] West Africa, weekly magazine, 1989, 26th June to 2nd July, p. 1040.

but only 20 % in the rural areas[6]. Furthermore illiteracy among women is worse in the rural than in the urban areas. In Benin it is 92.1 % and 59.0 % for the rural and urban areas respectively[7]. Indeed if technology should be improved, their access to education must first of all be improved. Strategies for improving women's access to education are highlighted in paragraphs 163-173 in the Nairobi Forward-Looking Strategies for the Advancement of Women[8].

6. Science and technology are the driving forces of economic and social progress. It must be an integral part of education to which every citizen is entitled. In addition improving women's access to education and training in science and technology (S&T) is the responsibility of the government and people of Africa particularly women. To this end, they have been active as is exemplified by the Arusha Strategies for the Advancement of Women in Africa[9] which describes issues in the area of S&T in industrial development for Africa, agriculture and food production, and human resource development. Paragraphs 200-205 of the Nairobi Forward-Looking Strategies for the Advancement of Women refer to S&T and paragraph 203 in particular recommends that "major efforts should be undertaken and effective incentives created to increase the access of women to both scientific and technological education and training". This working paper is part of the efforts being undertaken to achieve this goal.

7. The task of improving women's access to scientific and technological education will not be easy considering the cost of science educaiton and the fact that over 30 countries in Africa are still regarded as least developed. However since women are resourceful they must be encouraged to study S&T, and strategies must be developed to improve their access to education and training in S&T. There is need for women/girls in Africa to acquire new attitudes and values for effective living in a scientific world. Skills in handling technological products, attitude to scientific pursuits values of science are all areas of change which women in Africa need to be equipped with if they are to be effectively integrated into the development process.

8. This paper is a synthesis of three case studies undertaken in Kenya, Sierra leone and Swaziland on "Women and the Scientific Professions in Africa". The objective of the paper is to review and assess the level of womens enrolment in science-based training programmes and their involvement in scientific-based occupations. The paper has also attempted to review and assess career opportunities and prospects for women in the sciences. Progress made by women

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[6] Ibid.

[7] Women News, 1988, No. 25, p. 3.

[8] The Nairobi Forward-looking Strategies for the Advancement of Women: UN Decade for Women; Nairobi, Kenya, 1985.

[9] The Arusha Strategies for the Advancement of Women in Africa, 1985; UNECA, Addis Ababa, Ethiopia.

in Africa to enter into the scientific-based professions and training programmes since the UN Decade for Women is also reviewed. Recommendations and strategies for improving women's access to education and training in science and technology are presented.

9. Part I presents new trends in science and technology; part II outlines some of the barriers which prevent girls/women from actively participating in S&T training and professions; part III of the report deals with career opportunities and prospects for female scientists and technologists with suggestions for improving career opportunities and prospects for female scientists and technologists with suggestions for improving career opportunities and prospects; progress made by women in Africa, in entering science/technology based training programmes and the scientific professions since the UN Decade for women is reviewed and assessed in part IV. The paper concludes by emphasizing that women will have to be more instrumental in adopting the strategies suggested and recommendations made.

I. NEW TRENDS IN SCIENCE AND TECHNOLOGY

10. The rate at which S&T is advancing in the developed countries is very fast and this trend will continue. This is a challenge to Africa as she cannot affort to be left too far behind. These New and Emerging Science and Technology (NEST) include, biotechnology, microelectronics, computer technology, chemical technology and so on.

11. Some of these technologies have opened new possibilities that could be exploited to women's advantage. Microwave ovens have reduced the cooking time considerably. It also utilises less energy. International communication is now very fast thus elimination of communication barriers. For example fax, teleconferencing and distance education. Also the use of walk-man for educational purposes is also very popular.

12. This section will discuss the role of the United Nations Economic Commission for Africa (UNECA) in the information dissemination of NEST. Also NEST in the area of agriculture, energy and natural resources will be mentioned. Its effects on women's employment will be outlined. Finally recommendations are made which, if adopted, it is hoped would go a long way in reducing the technological gap between Africa and the developed countries.

UNECA's Role in the Dissemination of Information on NEST

13. The UNECA is very active in the dissemination of information on NEST to African governments. Being aware of the positive and negative impact of some of these technologies, ECA is making all effort to alert African governments to some of the opportunities; limitations and threasts posed by NEST. To this end several meetings, seminars and workshops have and will be held. African governments have also been urged to formulate national biotechnological policies and strategies. A meeting will also be convened to formulate strategies to lessen some of the adverse effect of NEST. Also study tours to Japan and Korea to find out how they

are coping with negative impacts will be planned[10]. Other computerised data basis at PADIS (Pan African Development and Information System) based at UNECA. An advanced Technology Alert System for Africa (ATAS-Africa) will be launched. ECA has also alerted African governments to some of the effects of NEST on agriculture, and natural resource exports.

Effects on Agriculture

14. Biotechnology has resulted in the production of high yield variety of crops. In Africa women produce most of the food in the rural areas. These varieties would increase productivity which would result in the increase in food production. The livestock production can also be increased with genetic engineering. This increase in productivity can result in increased income and living standards of women. On the contrary commodities such as sugar, palm-oil, and cacao could be produced by biotechnology at a lower cost in factories; leading to little or no demand for these commodities. Many women in farming would be put out of business. Female farmers will have to look for other sources of income or concentrate on the production of crops for which cheaper substitutes are not available. Not only female farmers will suffer but also national economies e.g. Côte d'Ivoire's and Ghana's economy depend a lot on the exportation of cacao.

Natural Resource Export

15. UNECA has also observed that with NEST, developed countries have been able to produce cheaper substitutes for natural raw materials such as aluminium, copper, iron, nickel[11]. As research on substitutes for natural raw materials improve the demand for these raw materials would decrease. It would affect the already ailing economies of many African countries. Zambia for exemple depends on the exportation of copper. One of the consequences would be increased unemployment. This trend has already been reported in the introduction of computer technology in south-east Asia.

Effect on Women's Employment

16. Goodman[12] has observed that the introduction of computer technology has had negative consequences for women's employment. In the same paper it was also suggested that there is need for active strategies regarding women's employment and technological change.

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[10] "Challenges for Science and Technology Promotion in Africa: Problems, Priorities and Action", 1988. German Foundation for International Development (DSE), Bonn, Germany, Karl Wkolfgang Menck (Ed).

[11] Ibid.

[12] Sara Goodman: "Impact of Technological Innovation on Women in Commerce and Industry" in Technology and Gender; Women's Work in Asia, 1987, p. 74. Ed: Cecilia Ng, Women's Studies Unit, UPM and Malaysian Social Science Association.

17. Stevens[13] [p. 101] also reported that the use of word processors have resulted in the unemployment of typists. In some African countries e.g. Sierra Leone, most of the typists are women. However the workload of those who have not been displaced have been lightened. The task of typing and correcting scripts have been made very easy. With home computers women can also work at home. The retraining of displaced women such that meaningful employment can be obtained has been suggested[14].

Energy

18. The production of renewable energy such as solar, wind and biogas would help a long way in solving the energy problem. Usually women have to walk long distances to fetch wood. If other sources of energy are available it would help towards cutting down on this chore. Deforestation and its attendant problems whould be solved thereby protecting the environment. Solar energy can be used in the drying of crops and in food procession. Once the initial cost of setting up o renewable energies have been borne, they need very little maintenance and no fuel[15]. They also have a long life span.

19. One setback is that women particularly in rural areas cannot afford to use some of these technologies. The provision of funds in the form of grants or credits has been suggested.

20. In order to narrow the gap between science and technology in Africa and the developed world, and also that more women benefit from NEST the following are recommended :

1. More research on NEST and its impact on women should be undertaken.

2. Girls/women should be encouraged to study new disciplines such as biotechnology, genetic engineering, computer technology and informatics.

3. Training opportunities in NEST within Africa should be increased.

4. African governments should formulate policies on the adoption of NEST.

5. Women be actively involved in the formulation, adoption and implementation of NEST policies.

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[13] "Science Technology and Women: A World Perspective" edited by S. Malcom, H. Morita-Lou, P.A. Boulaware and S.M. Burns. American Association for the Advancement of Science in co-operation with the Centre for Science and Technology for Development, U.N. 1985. AAAS Publication 85-14.

[14] Ibid.

[15] Ibid.

6. The active participation of women in workshops organized by UNECA be encouraged.

7. African governments be encouraged to make more effort in popularising NEST and its implications.

8. All users of NEST be made aware of some of the health hazards involved.

9. Further research into some of the health hazards involved be encouraged;

10. There should be more North-South cooperation in NEST to the benefit of all concerned.

II. OBSTACLES AGAINST THE ACTIVE PARTICIPATION OF FEMALES IN S&T TRAINING AND PROFESSIONS

21. In order that the access of girls/women to S&T training and profession be improved, the obstacles must be identified and strategies for overcoming them adopted. In this section the obstacles discussed are:

- lack of role models;
- negative cultural attitudes;
- the brain drain;
- the generally poor performance of girls;
- health and safety hazards;
- inadequate infrastructure and facilities; and
- the present economic crisis.

22. Recommendations are made on how to convert these stumbling blocks into stepping stones. Also recommendations are made in the areas of:

- training;
- policy women;
- rural women;
- the popularisation of S&T; and
- cooperation.

Lack of Role Models

23. Role models play an important part in attracting girls to S&T courses and S&T professions. If a girl has never encountered a woman scientist or technologist she will take it for granted that S&T are not for women but for men. She would also have no interest in pursuing a career in science or technology irrespective of whether she has the ability or opportunity.

Recommendations

1. Girls should visit industries, research and other institutions where women scientists and technologists hold top positions.

2. The achievements of women scientists and technologists should be publicised nationally and internationally on radio, televesion and in the newspapers.

3. These women scientists should also be interviewed on radio and television about their lives and work. These should be given maximum publicity.

4. The interviews should be broadcasted in indigenous languages where appropriate.

5. Women scientists and technologist should visit schools and give talks about career and job prospects in the different areas of S&T.

6. A national directory of women scientists and technologists and their achievements should be published in the official and indigenous languages and the publication should be widely circulated particularly to girls and women.

7. S&T prizes should be awarded to deserving girls/women at all levels of education.

8. Awards should also be given to outstanding female scientists and technologists.

9. Governments and other employees should make deliberate effort to appoint qualified women scientists and technologists to decision making positions.

10. A profile of African women scientists and technologists should be published and widely circulated regionally and internationally.

Negative Cultural Attitudes

24. The negative cultural attitude towards the education of girls and the higher premium placed by the society on marriage, motherhood and family life than in a career for women has contributed in no small measure to their marginal representation in S&T training and professions. It is believed that higher education jeopardizes a woman's chances of getting married. There is also societal pressures including peer pressure not to take up "Unladylike" professions such as being a motor mechanic.

Recommendations

1. Girls should not be given away early in marriage. Women should continue their education after marriage. Family life can successfully be combined with a career.

2. Teenage mothers should be given the opportunity to continue their education.

3. Governments should make every effort to improve the access of girls/women to education. A Women's Education Unit should be set up in all Ministries of Education. This Unit will among other things monitor the progress being made towards increasing the access of girls/women to education in general and S&T education in particular.

4. Girls/women should be encouraged by their parents, teachers and the society to study S&T up to university level.

5. Women's organizations should be instrumental in encouraging girls and women to study S&T.

Brain-Drain

25. The brain-drain has adversely affected the standard of education particularly science education and there is cause for concern.

26. There is in a lot of African countries a high level of out migration of scientists (teachers, lecturers and other professionnals) to the developed countries. Also after completion of their course of study these professionals continue residing in the host country or migrate to other countries in the North. There is also a movement of scientists and technologists out of the scientific professions into other areas which do not have any relationship to their scientific training.

Recommendations

1. Improved remuneration, working conditions and living standards of scientists and technologists.

2. Incentive should be given to science teachers e.g. science teachers allowance.

3. In order to combat this problem, governments should adopt a policy of improving the status and conditions of service of scientists and technologists.

Poor Performances

27. The generally poor performances of girls at the General Certificate of Examination Ordinary Level or its equivalent particularly in maths and physics prevent them from pursuing more advanced courses in the sciences. There are certain minimum entry requirements which must be obtained before their career can be continued. At this point quite a good number of girls give up studying the sciences.

Recommendations

1. The teaching of S&T must be thoroughly researched into particularly mathematics and physics. All efforts should be made to improve the standards of mathematics and physics at all levels of education.

2. The opportunity for further studies is highly dependant on the education received at earlier levels. Therefore more effort should be made by governments to improve the quality of primary and secondary education especially science education by providing the necessary inputs. Improved conditions of service for primary and secondary school teachers is recommended.

3. Governments should give high priority to the training of highly qualified teachers.

4. The methods of teaching of S&T should be improved upon. More use should be made of visual aids utilising local materials.

5. There should also be active students participation and emphasis should be laid on practical work and hands-on experience.

Health and Safety Hazards

28. This is of a particular threat to women in S&T. The health of their unborn children may also be affected.

Recommendations

1. Governments should enact and revise legislation to ensure a safe and healthy workplace.

2. Health and safety standards should be substantially enforced in all laboratories and working places.

3. There should be a safety officer in all institutions who would make sure that all safety standards are adhered to.

4. Unions should also ensure that there is proper and adequate health and safety conditions in the working places.

5. NGO's can also publicise data on health and safety thus raising public awareness.

Inadequate Infrastructure and Facilities

29. This is partly due to the rapid population growth rate in many African countries. Schools, colleges and other institutions have not expanded as fast as the population growth rate.

Recommendations

1. Governments should increase their budget to S&T education and adequate funding should be provided at all levels.

2. Governments with the help of NGOs can also seek funding internationally to improve infrastructure and facilities available in S&T institutions. Contributions in kind can also be solicited.

3. Institutions in collaboration with NGOs should also circulate budget proposals internationally and seek help both in cash and kind.

The present Economic Crisis

30. It has resulted in the high and escalating cost of education and of running S&T institutions. In some cases parents have no choice but to withdraw their children from school. Girls are usually withdrawn in preference to boys thereby contributing to the high drop out rate for girls. Also some women do not further their education after secondary school or university because of lack of funds. In some institutions courses are withdrawn because of costs and in certain cases only a few practical classes are organized. The running of S&T courses could be very expensive particularly practical courses.

Recommendations

1. More fellowships which should be widely advertised should be made available by governments, local business people, transnational cooperations and international bodies to girls/women particularly those from the rural areas. This should be given at all levels of education. The more prosperous African nations can also offer fellowships to female nationals of other countries.

2. Funding should also be sought by institutions nationally and internationally for the running of the institutions.

3. Judicious use should be made of funds and other available resources.

4. The sharing of teachers, facilities and resources where applicable is also recommended.

5. A national science equipment production, maintenance and repairs unit should be established in countries where they do not exist.

6. The development of low cost science equipment should be encouraged.

Other Recommendations

Training

1. The content, method and materials for the teaching of S&T must be revised to make them relevant to the needs and aspirations of girls/women.

2. Active pupil/student participation at all levels should be encouraged. More emphasis should be put on practical work.

3. Teaching methods should be improved at all levels particularly at the primary level. There should be in-service training for teachers at all levels with the aim of improving the quality of S&T education.

4. Career guidance and counselling by trained personnel should be available at all schools and colleges.

5. More emphasis should be put on maths and science at teacher training colleges particularly for primary school teachers. They should also be compulsory subjects for primary school teachers udergoing training.

6. The development of low cost S&T equipment should be part of teacher training at the primary and secondary school levels.

7. S&T education should be part of adult non-formal education programmes particularly in the rural areas. The curricula should relate to their everyday life.

8. Overseas exchange programmes, study tours and refresher courses should be organized.

Policy Issues

1. There should be more in policy making positions in the education field.

2. Governments should adopt policies and strategies to reduce the high illiteracy rates among women.

3. There should be education policies aiming at increasing the access of girls/women to education in general and S&T education in particular.

4. Science and technology policies and programmes should encourage the greater participation of women scientists and technologists in the development process.

5. Governments should prepare plans for improving endogenous technologies which will reduce the work load of women.

Rural Women

31. There is a focus on rural women because their access to the use of S&T and S&T education is less than that of the urban women. Moreover they are in the majority and they also produce the bulk of the agricultural produce. Therefore they must be given priority in S&T activities.

Recommendations

1. Efforts to reduce illiteracy rates among women in the rural areas should be intensified.

2. Girls/women in the rural areas should be assisted to improve their literacy in S&T by organizing seminars and workshops. These workshops should be organised by women NGOs.

3. When new technologies are introduced it must be ensured that the women are not displaced by men. Women and men should work in collaboration.

4. Research should be undertaken to assess the impact of newly introduced technologies on women.

5. Technologies introduced should be ones which the women can affort to use, maintain or hire.

6. Technologies which reduce their workload and increase productivity should be introduced. However it should be ensured that there is a market for the produce and also the rate of inflation should be such that increase production would result in an improvement in the standard of living.

7. Needs assessment surveys should be carried out to find out areas in which S&T training is needed most.

8. S&T research activities should give priority to the development of rural based technologies.

9. Research findings should be popularized and utilized particularly in the rural areas.

The Population of S&T

32. This can be achieved using the following strategies :

(a) Conscious effort must be made to popularize S&T by having frequent exhibitions, public lectures, essay competitions, radio and television programmes and so on, whereby the public would be informed of the potentials offered by the appropriate use of S&T;

(b) More use should be made of the mass media to popularize S&T particularly among girls and women in both the urban and rural areas. This would help to eliminate the attitude that some S&T fields are for men not to be trespassed by women;

(c) Radio and television should be used to present S&T in ways that are attractive and relevant to women especially those in the rural areas;

(d) The local languages should be used in the dissemination of S&T information to the public;

(e) S&T clubs should be formed for girls/women in shools, colleges and other educational institutions;

(f) The formation of a national association of women in S&T. This association will monitor and publicise activities to increase the participation of women in S&T and also plan workshops, seminars and other events. Other activities should inclure publication of a news letter.

Cooperation

33. In order that some of the above recommendations can be implemented there has to be cooperation at the nationa land international levels. At the national elvel government, NGOs, schools, colleges and other scientific institutions have to work together. At the international level the cooperation can be regional, North-South and South-South.

34. An inventory of S&T manpower, institutions and equipment should be available for every African country. This will facilitate the pooling of resources particularly in areas such as manpower, training, information and documentation.

Career opportunities and prospects for female scientists and technologists

35. Since the enrolment of women in S&T based training is low indeed, it is not surprising that they are marginally represented in the S&T professions.

In this section the following will be discussed:

- african Government's policy on career opportunities for girls/women;
- professions preferred by women;
- the effect of the current economic and debt crisis on job opportunities and prospects; and
- employers' prejudice.

36. Finally the present prospects is assessed and recommendations made to overcome some of the problems outlined.

Career opportunities

37. Most African Governments have education policies which cater for equal opportunities for career advancement for men and women. Examples of such countries are Swaziland[16], Nigeria and Tanzania[17]. Most women do not pursue S&T careers because of lack of interest or the prerequisite for pursuing the courses. Entry to such courses (both at home and overseas) is by merit and not by sex.

Professions preferred

38. Most women seem to prefer the biological sciences, medicine and allied professions. Professions in fields such as marine sciences and geology do not seem to appeal to women probably because they involve making long and extended field trips. This is not always very convenient for women who combine a profession with childbearing and childrearing, home and family life. There also seems to be more employment opportunities in areas such as architecture, engineering, computer science, medicine and allied professions than in the pure sciences such as physics, chemistry and geology.

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[16] "Research on Women and the Scientific Professions in Africa: The Case of Swaziland", 1988; UNECA.

[17] UNESCO Second Conference of Ministers Responsible for the Application of Science and Technology to Development in Africa, CASTAFRICA II; (Arusha, Tanzania, 6-15 July 1987). SC-87/CASTAFRICA II/5 prov. Paris, October 1987.

The effect of the economic crisis on job opportunities and prospects

39. Most African countries are going through an economic crisis and they are implementing structural adjustment programmes, which have adversely affected job opportunities and prospects especially in the public sector. Vacancies have been frozen. Also funding for research has been drastically reduced and most women have found it almost impossible to carry out meaningful research.

40. Devaluation is also having a harsh impact on salaries and some women have to take up other jobs (some not having anything to do with their professional training) to supplement their income. Others have found more lucrative jobs or are now business women. They are also isolated from the international S&T community because they cannot afford to subscribe to professional journals and cannot attend international conferences.

Employers' prejudice

41. In certain scientific professions (e.g. geology, fisheries) and in the area of technology, given a choice, most employers prefer men; so qualified women may not find it easy to get a job. Women are viewed as less technically competent than men. In Ghana it took quite a while for a female automechanic to get a job when she qualified because of employer's prejudice. However she does not expect problems getting promoted on the same basis as men[18].

Assessment of prospects

42. Considering the number of women in S&T professions in Africa and the number holding key positions, the prospects and chances of being promoted are good. African women in S&T professions also hold responsible positions in international organizations and in the developed countries for example Britain and America. In view of the above discussion the following recommendations are made.

At the national and local level

(i) The promotion of positive role models of female scientists and technologists;

(ii) Governments and NCC particularly should collect data to determine the present and future scientific and technological manpower needs;

(iii) There should be career guidance and counselling by trained personnel for girls in all schools and colleges;

(iv) The training of women in S and T should be in areas where the needs are greatest;

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[18] Commonwealth Currents, June 1989, p. 7; Published by the Commonwealth Secretariat, Marlborough House, London, England.

(v) Employment of female S and T students during vacation in local industries and institutions should be encouraged. This will provide them with some work experience thereby improving their job prospects;

(vi) Funding agencies should give priority to women in the allocation of funds;

(vii) In the light of the current wave of budget cuts and resultant redundancy, it is important that girls/women are encouraged to pursue careers in which the possibility of eventually being self-employed are great.

At the international level

43. International funding agencies should give more priority to women and should sponsor more research and study tours.

III. THE PROGRESS MADE BY WOMEN IN SCIENCE AND TECHNOLOGY IN AFRICA

44. There has been a steady but slow increase in the number of girls/women in science and technology professions in Africa since the mid-1970s. Efforts have been made by various international organizations and African governments to improve the access of women to science and technology training and professions. Below will be mentioned activities and progress made in some African countries, Nigeria, Zambia [19], Tanzania, Uganda, Ethiopia[20] and Sierra Leone[21]. The activities of some international organizations such as Commonwealth Secretariat, UNESCO, CIDA, (Canadian International Development Agency), TWAS as (Third World Academy of Science) in promoting the role of women in science and technology.

UNESCO

45. UNESCO which is in the forefront of promoting science and technology in developing countries organized CASTAFRICA II for African Ministers in Charge of Science and Technology for Development. This conference was held in Arusha, United Republic of Tanzania from the 8th - 15th July 1987. At this conference participating governments were strongly appealed "to promote the training of researchers, engineers, technicians and other specialists, paying special attention

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[19] "Promoting Science Technology and Mathematics among Girls and Women in Nigeria", 1989. Proceeding of workshop held in Lagos, Nigeria, 30th November - 2nd December 1987. Federal Ministry of Education, Women Education Branch, Lagos, Nigeria.

[20] Report of a Discussion on the 'Role of Women in Science and Technology in Ethiopia", 1988; UNDP, Addis Ababa, Ethiopia.

[21] University of Sierra Leone Quarterly, 1988, 1,2.

to the training of women and encouraging the use of African expertise. Also at the same conference recommendation No.4 focused on "Women in Science and Technology", among the recommendations were that Member States are to encourage the participation of women in science and technological activities including appointment to managerial positions, to membership of governing boards of S&T institutions and to high level delegations".

46. At this same conference (UNESCO CASTAFRICA II), it was reported that in Nigeria both men and women receive the same quality of education and the number of women working in science research laboratories had increased. A national programme for the education of women had also been launched. Legislation against unduly early marriage and premature withdrawal from school is under consideration (p. 30)[22].

47. With the help of UNESCO a two week "science clinic" was organized in Ghana. The purpose of the clinic was to expose girls who have shown aptitude for Science Technology and Mathematics (STM) and also to help improve the quality of science teaching in Ghanaian schools.

48. Also in Nigeria in November 1987 a workshop was held on "Promoting Science, Technology and Mathematics Among Girls and Women in Nigeria". It was organized by the Federal Ministry of Education, Women Education Unit. This was a follow-up of a workshop held in Ghana in January, 1987, "Commonwealth African Regional Workshop on Gender Stereotyping in Science, Technology and Mathematics Education" funded by the Commonwealth Secretariat. At the Nigeria workshop barriers preventing women and girls in participating in science, technology and mathematics education were identified and recommendations made to overcome them. One of the recommendations made which has been implemented is the formation of "Nigerian Association of Women in Science, Technology and Mathematics (NAWSTEM). This association among other things will:

- encourage the learning of STM at all levels of formal education for women and girls;

- identify specific strategies to promote the application of STM in the daily lives of Nigerian girls and women; and

- identify strategies for promoting programmes that will encourage females into STM careers.

49. At the CASTAFRICA II conference, it was also reported that to redress the imbalance between male and female participation in STM the Zambian government has taken the following steps:

- reduction of entry marks for girls in junior secondary schools;

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[22] UNESCO CASTAFRICA II.

- making and science compulsory at lower levels;

- emphasis having been put on mates and science in teachers' colleges; and

- persuasion of boys and girls to take practical subjects hitherto designated for boys or girls and vice versa e.g. boys are encouraged to study home economics, and girls science, engineering, woodwork etc.

50. At the CASTAFRICA II conference the delegation of Tanzania reported that the number of women doctors, pharmacists, engineers and technicians had steadily increased since CASTAFRICA I, held in 1974. The government was making deliberate efforts to integrate more women into scientific activities by providing equality of opportunities with men in this field.

The Commonwealth Secretariat

51. As part of the Commonwealth Secretariat's Action Plan on Women, the Secretariat's education programme will be producing a booklet on the role of African women in their countries' scientific and technological development. Photographs of about a hundred African women scientists, technicians and mechanics and interviews with them about their lives and work will form the basis of the booklet. It is aimed at reversing the high drop out rate of girls and young women at all levels of education. The target groups are young women, teachers, parents, educational administrators and cultural leaders. Tapes of the interviews will also be available to local radio stations[23].

52. This project will contribute a long way to promoting positive role models of women scientists. It is also a strategy to increase the number of girls/women in science-based training and professions. This booklet will be useful to many and no doubt many governments, national, international, and women's organizations are looking forward to its publication. It is fervently hoped that both the booklet and tapes will be given maximum publicity.

Other conferences/seminars held

53. Numerous seminars and conferences have been held on women science and technology among them are:

- "The Role of Women in Science and Technology in Ethiopia" held in Addis Ababa, Ethiopia in November 1988; and

- The CIDA/TWAS conference on "The Role of Women in the Development of Science and Technology in the Third World". This was held in Trieste, Italy in October 1988.

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[23] Commonwealth Currents, June 1989.

54. At this conference there was an African Region Round Table meeting. The discussions included: the Role of Women Scientists in addressing the problem in rural areas and the status of women in science and technology in Africa.

55. It was agreed that the status of women in science and technology in Africa is very low. It was pointed out however that there is a steady but slow increase in the number of women studying or engaging in science and technology fields with the larger percentage in biological and medical professions[24].

56. In September 1983 there was an ad hoc panel of experts meeting "Science, Technology and Women" at South Hadley, Massachussetts, United States of America from 12 to 16 September 1983. At this meeting a delegate from Uganda reported that the General Technical Education (GTE) is emerging as a compulsory subject in schools for both boys and girls. It includes woodwork, elementary mechanics, and working with electrical appliances.

57. In some countries the number of females studying certain science discipline is increasing. Table 1 below gives the percentage of female students at the University of Nairobi, Kenya who studied certain disciplines in 1980/81 and 1987/88 at the undergraduate level.

Table 1: Percentage of female students and discipline studied at the University of Nairobi, Kenya, 1980/81 and 1987/88

Discipline	% Females 1980/81	% Females 1987/88
Architecture and design	13.5	15.7
Building engineering, land economic	17.8	22.4
Engineering	1.5	2.8
Science	10.5	15.9
Veterinary medicine	11.3	13.1

At the post graduate level there is also an increase in the number of females pursuing certain courses as is shown in table 2.

[24] Conference report on "The Role of Women in the Development of Science and Technology in the Third World". Held in Trieste, Italy, 1988, jointly organized by CIDA and TWAS.

Table 2: Post graduate courses

Discipline	% Females 1980/81	% Females 1987/88
Architecture and design	11.7	28.6
Building engineering, land economic	18.2	19.1
Science	11.9	12.7
Veterinary medicine	9.3	16.7
Institute of Computer Science	Not stated	35.7

Source : Research on Women and Scientific Profession in Africa: A Case Study of Kenya, UNECA 1988, p. 10 and p. 11.

58. Also at Fourah Bay College University of Sierra Leone, the number of females enrolled in the engineering faculty is increasing as is shown below:

Table 3: The number of female students enrolled in the Engineering Faculty 1981/82 - 1985/86

Year	No. of Females	Total No. of students
1981/82	4	142
1982/83	7	141
1983/84	11	134
1984/85	12	139
1985/86	13	52

Source : The Registry, Fourah Bay College.

59. The above are just a few examples of the achievements of some female scientists in Africa, and efforts been made by some African Governments and International Organizations. They are by no means exhaustive.

Conclusion

60. Some of the reasons for the low enrolment of women in S&T training programmes which has resulted in their marginal representation in S&T professions have been identified. Strategies have been suggested for improving this situation. However since the mid-1970s the number of women in science-based professions has increased slowly. One must not expect too much too quickly considering the numerous problems facing the African continent like war, and famine, debt crisis.

61. To achieve the goal of improving women's access to education and training in S&T, a concerted effort is needed. Organizations such as the African Regional

Centre for Science and Technology in Dakar, Senegal and the African Academy of Science in Nairobi, Kenya can continue to play an active role. Women in particular will have to be more active in the implementation of the recommendations and strategies.

62. Financial resources will also be needed. However with proper planning and judicious use of resources a lot can be achieved in a short time. The will is there, and no doubt further progress will be made at a faster pace.